

CHAPTER 4 LIGHTING

4-1. Basic considerations. The design of lighting systems will be developed to provide comfortable visibility conditions having adequate intensities for the safe and effective accomplishment of the tasks to be performed. The finish and color of room surfaces will be coordinated with the lighting system design to reduce glare, increase light utilization, and attain an acceptable brightness ratio. Light sources and fixtures will be selected to provide the most efficient and economical system practicable.

a. General illumination levels. General illumination levels will conform to the recommendation of the Illuminating Engineering Society (IES) Lighting Handbook as modified by DOD 4270.1-M. Such illumination levels reflect maximum authorized levels of illumination for military facilities. Deviations therefrom within a range of plus-or-minus 10 percent of that indicated are acceptable where space configuration or fixture arrangements dictate. Deviations from illumination levels beyond the plus-or-minus 10 percent range will be fully justified and documented in the project design analysis and will be authorized only where specifically approved.

b. Light sources. Florescent lamps will be used to the maximum extent practicable. Generally, high-pressure-sodium vapor type sources will be used for medium- and high-bay applications where color rendition is of no concern, for exterior fixtures mounted on buildings, and for parking area or walkway illumination. Where effective color rendition is required, the most efficient and economical source which provides the required illumination levels and chromaticity will be used. Incandescent lamps may be used in living areas of bachelor officer quarters and similar areas where low illumination levels combined with intermittent use would render other sources uneconomical, such as janitors' closets. Consideration may be given to the use of incandescent sources in hazardous locations, where life-cycle cost analyses indicate that such is advantageous versus other suitable sources, including energy costs.

c. Lighting fixtures. Lighting fixtures will be selected to provide the most appropriate design commensurate with the application and the source used. Generally, fixtures will be of standard commercial manufacture, except that special fixtures may be used where required by the architectural treatment of the building. Non-standard fixture requirements will be detailed on the project construction drawings and accompanied by competitive specification require-

ments. Locations and spacings of fixtures will be coordinated with structural, mechanical, and other design requirements. Selection and hanging of fixtures in large rooms having high or sloped ceilings will be accomplished so that any required architectural effect or function will not be impaired. In air-conditioned areas having minimum illumination levels of 50 footcandles or more, fixtures will be suitable for use as an integrated air-conditioning and lighting system component. Dropped-dish diffusers may be used with fluorescent fixtures for decorative purposes in small offices or similar areas. The use of wrap-around lenses with fluorescent fixtures will be avoided wherever practicable to eliminate lens or hinge breakage associated with normal lamp replacement. Fluorescent fixtures normally will be of the 4-foot type, except that 8-foot fixtures may be used where requested and approved by the Using Service. The difficulties and costs associated with the storage and replacement of lamps for 8-foot fixtures render such fixtures unsuitable in some areas. Other lamp types suited to specific needs, such as "U"-shaped lamps, may be used in limited applications where linear 4-foot lamps cannot be employed.

d. Exit and emergency lighting. Exit and emergency illumination normally will be provided as required by NFPA No. 101. Emergency lighting systems will also be provided in key communications and other facilities where continuity of operation or protection of life and property is essential. Exterior exit steps or ramps will be lighted for egress safety, except that separate fixtures for that purpose will not be provided where other permanent exterior lighting provides the necessary illumination at the steps or ramps. Generally, exit and emergency lighting supplied by auxiliary sources will be provided by integral, battery operated fixed lighting units. Where clearances for headroom and passage would be encumbered due to low ceilings or narrow walkways, battery-operated fixed lighting units supplied by a central storage battery may be used. When an alternate power source such as a generator is available, that source normally will provide the sole auxiliary support for the exit and emergency lighting system.

4-2. Criteria for specific facilities.

a. Military nomenclature. Spaces within military facilities having specific functional requirements are frequently identified by different nomenclature than those of the civilian sector identified in the IES

Lighting Handbook. The space nomenclature cross-references provided in DOD 4270.1-M provide clarification of the most commonly encountered spaces, and serve a convenient comparison of such nomenclature. Additional cross-references in table 4-1 will assist in the selection of the proper illumination level for such space.

Table 4-1. *Military/Civilian Facility Description Comparisons*

<u>Military Description</u>	<u>Civilian Description</u>
Club dining rooms	Intimate-light environment
PX-snack bars	Quick service normal environment
Guard houses, stockages	Municipal buildings - fire and police
Military vehicle parking	Attendant parking

b. Space illumination for specific facilities other than indicated in these criteria will conform to the following:

(1) Barracks sleeping areas will be provided with fixed overhead fluorescent lighting, recessed wherever practicable, or ceiling surface-mounted. Where specifically authorized, on a project-by-project basis, incandescent fixtures (resistant to vandalism) may be used. Such permanent fixtures will be switched at each bed or desk location for wall-mounted units or at the room entrance for ceiling-mounted units. Open-bay barracks sleeping areas will be provided with ceiling-mounted fluorescent fixtures, switched for sub-area illumination.

(2) Communications facilities normally will be illuminated by fluorescent fixtures arranged parallel to equipment aisles to provide the necessary illumination and avoid conflict with overhead cable trays. Where manual telephone or other communications switching equipment and consoles are used, fixtures will be selected and positioned to avoid glare on and undesirable reflections from equipment surfaces.

(3) Facilities such as Service clubs, ballrooms, and lounges serving multiple functions, will have the general illumination arranged for multiple switch or manually operated dimmer control. For ballrooms of 2,000 square feet or larger, general illumination may be controlled by solid-state or motorized dimmers having control stations at both the main entrance and bandstand. Convenience outlets will be provided for the connection of portable spotlights, floodlights, or accent lights in coordination with the Using Service.

(4) Illumination for training facilities will conform to the following:

(a) Fixtures in classrooms which are located immediately in front of lecture platforms will be controlled both at the speaker's location and the room entrance.

(b) Fixtures providing general illumination in auditoriums will be switch- or dimmer-controlled to

permit a reduced lighting level suitable for note-taking during use of audio-visual aids. Fixture controls will be located both at the entrance and at a control position off-stage.

(c) Fixtures in indoor rifle ranges will be of the indirect incandescent or low-brightness fluorescent type where located in the firing area to minimize undesirable reflections. Firing lane and target fixtures will be protected from stray bullets by metallic shields.

(5) Fixtures in warehouses will be arranged to suit the warehousing technique employed. For pallet storage of large items, general illumination will be confined to main aisles, and will be supplemented with localized fixtures located in the aisles and directed into the storage areas. Trolley-mounted luminaires may be provided in storage areas where the type of operation changes frequently and shifting of fixtures is desirable and practicable. Fixtures will be controlled from panelboards, except that at aisle intersections and intermediate key points, fixtures may be controlled remotely by low-voltage switches. Adjustable type dock lights will normally be provided adjacent to loading doors to illuminate truck or rail car interiors.

(6) Lighting systems in weapons system control and launch areas will be designed in coordination with the Using Service for the conditions encountered. Low levels of illumination (30 footcandles or less, generally) are required to permit observation of luminous dials and panels without reflected glare or undesirable contrast in brightness. Separately controlled fixture arrangements will be provided for both normal operations and maintenance activities.

(7) Lighting intensities in maintenance areas, such as utility crawl spaces and tunnels and walk-in pipe chases, will be approximately 1 footcandle for the safety of maintenance personnel. Fixtures will be controlled by switches with pilot lights located in a normally occupied area. Convenience outlets will be provided at various locations for connection of portable fixtures and tools.

c. *Relamping in high-bay areas.* Special provisions will be made for lamp replacement in high-bay areas such as gymnasiums, handball and squash courts, hangars, shops, and indoor swimming pools. In certain instances, judicious location of fixtures, such as by locating directional-beam fixtures beyond pool perimeters as opposed to above the water surface, may improve accessibility. In other instances, additional means to provide the necessary accessibility will be provided as required. In all cases, design responsibility will include investigation to determine whether suitable lamp maintenance facilities such as scaffolding are available on base, determination of the practicability of using such maintenance facilities

for the project in question (e.g., can the scaffolding be transported through the small squash court doors), and identification of such facilities and documented coordination with the Facilities Engineer in the design analysis. If suitable maintenance facilities are not locally available, an appropriate and economical means for facilitating lamp replacement will be selected in coordination with the Facilities Engineer and the Using Service. Among the means to be evaluated will be fixture lowering devices, suspended

fixtures, boatswains chair systems, fixed catwalks with handrails, movable telescopic-type lift platforms, movable collapsible-type scaffolding, and truck-mounted collapsible-type derricks or movable arms (cherry pickers). The appropriate selection will be indicated in the design analysis and, where funded by the project, in the contract documents. Portable and movable equipment will be furnished by the Using Service and the design will include provisions for bringing such equipment into and out of the building.